STATE OF SOUTH CAROLINA

BEFORE THE PUBLIC SERVICE COMMISSION

Docket No. 2021-66-A

In the Matter of: South Carolina Office of Regulatory Staff's Motion to Solicit Comments from Utilities and Other Interested Stakeholders Regarding Measures to Be Taken to Mitigate Impact of Threats to Safe and Reliable Utility Service	**GOOGLE, LLC'S FILED COMMENTS**

Google, LLC (hereinafter, "Google"), by and through its undersigned counsel, pursuant to the Public Service Commission of South Carolina's (the "Commission") March 10, 2021 Order (the "Order") opening the above-captioned docket, as well as pursuant to the Commission's Rules and Regulations of Procedure, hereby submits these filed comments in the above-captioned proceeding to consider matters related to the ongoing safety and reliability of utility service in South Carolina. In timely submitting these initial comments, Google hereby expressly reserves the opportunity to amend, supplement or submit additional comments or testimony, whether in writing or at any hearing, either directly or in response to those made by other participants. Google will do so in accordance with any schedule set by the Commission, including in the Order, or as further permitted by the Commission.

1. Introduction

The severity and length of the power outages that occurred in Texas in February 2021 has generated intense scrutiny from energy market participants, regulators, key decision-makers, and

the general public across the United States. South Carolina is no exception, and the events in Texas are undoubtedly a key factor in the opening of a docket and development of the current proceeding.

While lessons continue to be learned about what transpired to cause the Texas outages, certain key facts have become clear over the last few months. As a major energy consumer in South Carolina, the Southeast, Texas, and the US, Google believes it is vitally important that these facts be properly contextualized so that the right lessons are learned to ensure reliability going forward.

Moreover, Google is acutely aware that some interest groups are seeking to promote the false notion that the Texas outages were primarily due to the RTO market design that existed in Texas, and the RTO construct more generally. These claims insinuate that an RTO construct should be avoided in the southeast. We believe this conclusion is not only wrong but may actually be harmful to grid reliability in South Carolina. As such, Google provides these comments to dispel the notion that the RTO structure was inherently at fault for the Texas outages.

To do so, we will describe several of the key factors that caused the Texas outages. In doing so, we will aim to differentiate between 1) factors that were primarily due to physical performance of the infrastructure in place regardless of market design, and 2) factors where market design issues likely played a role. Furthermore, for the factors where market design issues played a role we will discuss why most of these are not inherent to the RTO model itself, but were unique to Texas' approach and need not be replicated elsewhere.

Of the seven RTOs/ISOs in the United States, no two are exactly alike. Each RTO/ISO differs in the kinds of markets it operates, how it is structured, and how it is regulated. There is no one-size-fits-all RTO design; each market can be structured according to local priorities and needs.

Indeed, a well-organized wholesale market could actually make failures like what occurred in Texas much less likely.

1.1 Background of the Texas Energy Crisis

In mid-February of this year, Texas experienced an energy crisis as a result of a polar vortex that caused temperatures to drop to lows not seen in more than 30 years.[1] Winter storms battered the state for nearly seven consecutive days.[2] ERCOT – which serves as the grid operator for most of the state – entered emergency operating conditions on Monday, February 15, 2021, and resumed normal operating conditions on Friday, February 19, 2021.[3] At the height of the crisis, approximately 48.6% of generation (approximately 52,000 MW) was forced offline,[4] leaving more than 4.5 million customers across the state without power.[5] The outage rate was so high that many homes lost power and essential supply for more than three days. More than 80 people lost their lives due to the crisis.[6]

1.2 About ERCOT

According to its own website, the Electric Reliability Council of Texas (ERCOT) manages the flow of electric power to more than 26 million Texas customers -- representing about 90 percent of the state's electric load. As the independent system operator (ISO) for the region, ERCOT schedules power on an electric grid that connects more than 46,500 miles of transmission lines and 710+ generation units. It also performs financial settlement for the competitive wholesale bulk-

[1]https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages
[2] https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/
[3]http://www.ercot.com/content/wcm/key_documents_lists/225373/Urgent_Board_of_Directors_Meeting_2-24-2021.pdf
[4] Id.
[5] https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/
[6]https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages

power market and administers retail switching for nearly 8 million premises in competitive choice areas.

ERCOT is a membership-based 501(c)(4) nonprofit corporation, governed by a board of directors and subject to oversight by the Public Utility Commission of Texas (PUCT) and the Texas Legislature. Its members include consumers, cooperatives, generators, power marketers, retail electric providers, investor-owned electric utilities, transmission and distribution providers and municipally owned electric utilities.[7]

2. Physical Performance Issues

During the February winter storm, Texas endured a critical combination of high demand and low supply. Freezing temperatures caused natural gas production to plummet, and ill-prepared power plants went offline. At the same time, Texans tried to heat their homes in unusually cold conditions, resulting in soaring demand for both electricity and natural gas. Without the ability to import power from neighboring grids and shortages in fuel supply, the state's power system was unable to meet demand.

This section describes some of the key physical performance issues on the ERCOT grid that contributed to the February outages. Some of these issues are unique to ERCOT (e.g., an islanded grid). Others reflect general power system issues that potentially could occur in both RTO and non-RTO settings (e.g., lack of power plant winterization).

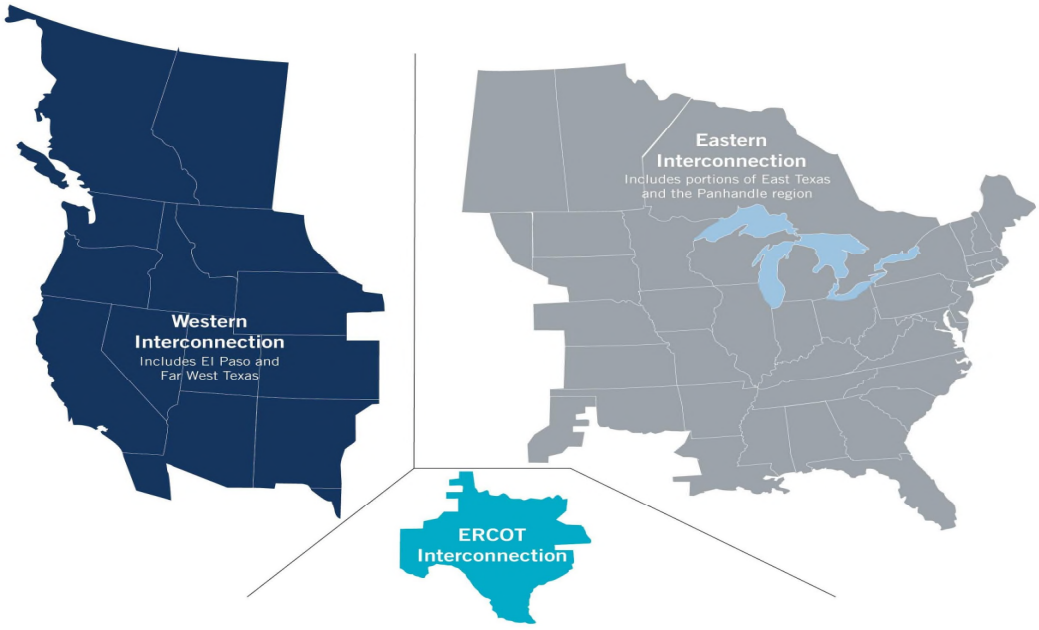
[7] http://www.ercot.com/about

2.1 Islanded Electrical Grid

The Texas power grid operates as an island and was unable to rely on neighboring systems for assistance during the February winter storm.

In the US, the power system is comprised of three main interconnected grids – the Eastern Interconnection, Western Interconnection, and ERCOT. Within each of these interconnections, all generators are synchronized to the same frequency, and AC power flows can occur throughout the region. While there are a handful of DC interties between the three interconnections, transfer capability over these interties is very limited and does not account for a significant amount of power flow between interconnections. The area served by the ERCOT market in Texas is limited to the ERCOT interconnection. This makes the ERCOT ISO somewhat unique in the US. Not only is ERCOT physically separated, but it is also much smaller than the Western and Eastern systems and operates as an island. This means that the state cannot import power when it is needed, nor can the state export power during times of excess generation.

Figure 1. NERC Interconnections



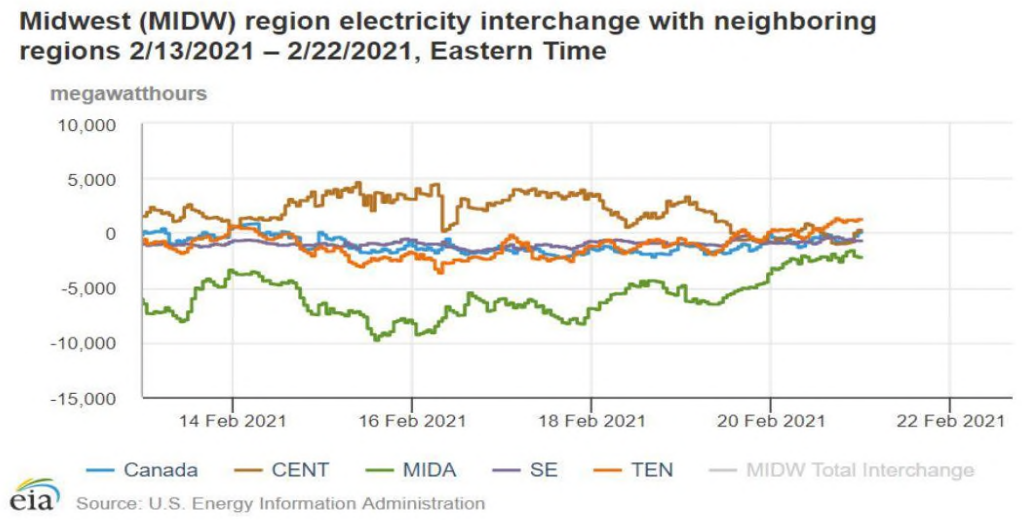
Source: ERCOT, http://www.ercot.com/news/mediakit/maps

Other RTOs in the Eastern Interconnection are not islanded and assisted each other during the February winter storm.

During the February energy crisis, RTOs within the Eastern Interconnection, such as the Southwest Power Pool (SPP) and the Midcontinent Independent Service Operator (MISO) still faced significant challenges in meeting demand but fared much better than ERCOT because they could rely on each other and their neighboring systems to the east (e.g., PJM), for additional electricity imports when local supply was scarce.[8] The Eastern Interconnection comprises a grid that covers a much larger geographic footprint than ERCOT, enabling access to the reliability benefits of a much larger generation portfolio and regional variations in energy demand.

As shown in the figure below, both MISO and SPP were importing power during the February winter storm. The largest amount of this came from PJM which exported up to 10 GW of electricity to MISO, and MISO, in turn, exported around 1 GW to SPP. However, power was also imported from other regions including Southern Company, TVA, and Canada.

Figure 2



RTO:	Canada	SPP	PJM	Southern Pool	TVA	MISO
Shown As:	Canada	CENT	MIDA	SE	TEN	MIDW

[8] https://www.nrdc.org/experts/toba-pearlman/benefits-more-connected-grid-miso-and-spp

Above Image Source: Southern Renewable Energy Association, February 22, 2021.
Data Source: EIA Hourly Electric Grid Monitor, Midwest region electricity interchange with neighboring regions.

It is worth noting that ERCOT operates a power system where both the physical grid and the market operations are islanded from other systems. In other regions, such as the Eastern Interconnection, grid operators may not be as *physically* islanded from each other but can still be *organizationally* islanded in terms of how each local balancing authority area (BAA) operates and how generation is dispatched. The existence of physical tie-ins between these local balancing areas provides some additional reliability benefits, however without meaningful coordination and agreements in place, the ability to share power becomes much less effective. South Carolina's case may provide an example of such a situation, where multiple BAAs exist within the same physically interconnected region, but coordination between these areas is somewhat limited.

Consolidation of these BAAs into a single RTO would inherently coordinate these operations and thereby enhance the reliability benefits of resource sharing during extreme conditions. Moreover, this could streamline the ability to coordinate with other RTOs during extreme events, as well as for planning purposes, due to the fewer number of joint operating agreements necessary.

2.2 Lack of Power Plant Winterization

Failures occurred across generation types during the February winter storm.

All fuel types – including natural gas, coal, and renewables – were negatively impacted by the severe weather causing generator outages and fleetwide capacity factors to drop significantly. As ERCOT reported, the average capacity factor dropped from 52% to 43% for gas, from 73% to

60% for coal, from 94% to 75% for nuclear, and from 19% to 14% for wind.[9] Subsequently, grid operators say it simply does not make sense to pinpoint any one generation source for criticism.[10] Because fossil fuels are responsible for more production, they were also the source of more failures, with the most significant gap from natural gas and coal facilities. At times during the February storm, there was more than 30 GW of thermal (coal, gas, and nuclear) capacity offline, accounting for more than 40% of the total thermal capacity. This was more than double ERCOT's projections for an 'extreme outage' scenario of 14 GW of thermal-capacity outages.[11]

Many power plants in Texas were unable to run in February 2021 because they were not properly winterized to allow them to handle extreme cold conditions.

Texas's energy system was generally under-prepared to function under the extreme winter conditions it experienced in February 2021. In most years, peak power demand in the ERCOT system occurs in the summer and thus most power plants are designed to meet summer peaking needs, rather than winter peaking needs. As such, many plant owners decided to forego certain investments necessary to winterize these plants and allow them to operate in extreme cold. This includes both thermal resources like natural gas, as well as renewable resources like wind. Winterization measures for all generation types are commonplace in colder climates where peak demand generally occurs in winter.

It is worth noting that temperatures as low as the ones seen in February are rare in Texas, but not unprecedented. The state had experienced unusually cold weather in prior years, and, despite clear warnings from grid reliability experts, the Texas grid failed to adapt accordingly. In

[9] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/
[10]https://www.npr.org/sections/live-updates-winter-storms-2021/2021/02/18/968967137/no-the-blackouts-in-texas-werent-caused-by-renewables-heres-what-really-happened
[11]https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages

part, this is due to a lack of regulatory oversight. No entity, including PUCT or ERCOT, has rules to enforce compliance with weatherization plans or to enforce minimum weatherization standards. And no matter the market structure, any weatherization standards would have to have regulated cost controls to ensure safe compliance. Subsequently, generation owners and operators are not required to implement any minimum weatherization standard or perform an exhaustive review of cold weather vulnerability.[12]

For example, ten years ago – in February 2011 – a cold spell in Texas caused outages affecting millions of customers. While the magnitude of this event was less severe than the one in 2021, there were many similarities between the two events. Following the 2011 outage, the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC) released a report studying the causes of the outages and recommending a suite of measures to harden electricity and natural gas infrastructure. These recommendations appear to have gone largely unheeded by both market participants and regulators in Texas. For example, the 2011 report concluded, "Many generators failed to adequately apply and institutionalize knowledge and recommendations from previous severe winter weather events, especially as to winterization of generation and plant auxiliary equipment."[13]

The 2011 report acknowledged that it is difficult to know what level of investment is prudent in protecting the grid against unusual weather events. However, the report task force believed that the needed fixes would not be unduly expensive and would improve resilience to

[12] http://www.ercot.com/content/wcm/key_documents_lists/225373/Urgent_Board_of_Directors_Meeting_2-24-2021.pdf.

[13] Staffs of the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation (August 2011), *Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011: Causes and Recommendations*, August 2011, https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf, pgs. 195-217.

cold weather in a cost-effective way.[14] Nonetheless, the report's recommendations were unheeded and never made mandatory.[15] If the PUCT and/or ERCOT had taken steps to require or incentivize winterization of power plants, then the effects of the February winter storm would undoubtedly have been much less severe.

Beyond winterization, the 2011 report also made a number of other recommendations across planning and reserves; coordination among transmission owners, balancing authorities, and generation owner/operators; communications; load shedding; and natural gas. A summary of the recommendations from this report can be found in the Appendix.

Since the 2011 report, multiple additional weatherization reports and recommendations were issued, including:

1. A 2012 report by the PUCT on weather preparedness best practices,[16]
2. A 2014 report by the Texas legislature on reliability issues,[17] and
3. A 2014 review by NERC of that year's polar vortex.[18]

These reports made similar recommendations to the 2011 FERC/NERC report with few results.[19]

Winter power plant outages are not caused by RTOs and must be planned for under any market construct.

The effects of winter weather on power plants are universal and not something unique to any specific market construct within an RTO or non-RTO environment. Even under a non-RTO environment, plants across a range of generation types are vulnerable to outages from cold weather. As a point of comparison, it is important to note that there are also significant winter outage rates

[14] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/
[15] https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/
[16] https://lrl.texas.gov/scanned/SIRSI/PUC_report_39646.pdf
[17] https://capitol.texas.gov/BillLookup/History.aspx?LegSess=82R&Bill=SB1133
[18] https://www.nerc.com/pa/rrm/Pages/January-2014-Polar-Vortex-Review.aspx
[19] https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/

at South Carolina generation facilities. In the case of Duke Energy, these outage rates are documented in their recent Resource Adequacy study.[20]

While ERCOT stands out in terms of its failure to take steps to address prior warnings, there is nothing inherent about the RTO concept itself that led to this. It is possible that some generation owners sought to avoid the installation of winterization measures, in order to minimize their costs in ERCOT's competitive market. However, there are many ways to structure the RTO market design differently to reward generators for making these investments.

Additionally, this simply underscores the importance of effective regulatory oversight. Although Texas exhibited a unique lack of regulatory oversight over weatherization, this need not be the case elsewhere. For example, state utility commissions generally have broad authority in determining what constitutes Resource Adequacy. While Texas did not take this approach, state commissions could require RTO participants to take steps to winterize their plants as a condition for market participation.

2.3 Failures at Gas Production Wells

Gas production wells in Texas, like power plants, were not winterized, resulting in a 40% drop in production during the February winter storm.[21]

At the peak, about 18.7 billion cubic feet per day of gas production were lost – equivalent to about a fifth of total US output.[22] In low temperatures, facilities at production wells "froze-off" as water and other liquids froze and blocked the flow of gas out of the wellhead. Logistical issues from the weather storm, such as icy roads, further impeded normal field operations.[23]

[20] For example, see Figure CA4. 2015 & 2018 Historical and Modeled Purchases (unredacted) in the Confidential Appendix to Duke Energy Carolinas 2020 Resource Adequacy Study, Docket 2019-224-E.
[21] https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages
[22] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/
[23] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/

Overall gas supply dropped by approximately 56%. Some production was lost not directly to freeze-offs, but because production equipment lost power, creating a negative feedback loop of dwindling gas and power supplies. Without gas feedstocks, power plants could not generate power, and without power, gas wells could not produce gas.[24] This suggests that, even if all gas-fired power plants had been weatherized and fully operational, they still may not have been able to secure adequate gas supplies without regulatory intervention to further shut down industrial demand or exports.[25]

Throughout the industry, there is a growing recognition of the need to better coordinate the gas and electric systems, to prepare for and avoid these circumstances. Generally speaking, however, the system of natural gas production falls outside of the domain of the electricity system operators. Thus there is little ability for entities like ERCOT to influence steps taken by gas suppliers to winterize their systems. This is equally true for system operators in RTOs like ERCOT, and for non-RTO system operators, like those in South Carolina today.

2.4 Inefficiency of End Use Consumption

In recent years, Texas has achieved relatively low levels of electricity savings through energy efficiency when compared to the national average.[26] According to the American Council for an Energy Efficiency Economy (ACEEE), Texas ranks in the bottom half of states regarding its efforts to improve energy efficiency and received a "zero" score for efficient appliance standards. Approximately 60% of Texans use electricity for heating, mostly low-efficiency resistance heat, in poorly insulated homes.[27] Since natural gas for home heating is prioritized over

[24] https://www.texasmonthly.com/news-politics/texas-blackouts-natural-gas/
[25] https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-power-and-gas-blog/the-texas-power-crisis-shining-a-light-on-the-generation-outages
[26] https://www.aceee.org/sites/default/files/pdfs/ACEEE_ScrSht20_Texas.pdf
[27] https://www.utilitydive.com/news/lessons-from-the-2021-texas-electricity-crisis/596998/

fuel for power plants,[28] the inefficient appliances and lack of insulation in homes likely exacerbated the crisis in multiple ways.

Generally speaking, utilities in the state have not focused on natural gas efficiency, and large customers are allowed to opt out of ratepayer funded energy efficiency program.[29]

In addition to increasing the efficiency of end uses, there could be other improvements made to enhance demand-side flexibility. While ERCOT has a robust demand response program, there are market rules that may be preventing even more robust participation.[30]

3. Market Design Issues

In addition to the underlying physical issues described in the previous section, there are several elements of ERCOT's market design that may have contributed to the energy crisis in February, which will be addressed in this section. As we will point out, each of these market design issues are not universally true for all RTOs. In fact, most of them are somewhat unique to ERCOT and could readily be approached differently in other regions.

3.1 Lack of Regulatory Oversight and Coordination

Because of the intrastate nature of its grid, ERCOT is not under the jurisdiction of the Federal Energy Regulatory Commission (FERC).[31]

As discussed above, the Texas grid is nearly entirely separate from the rest of the country, so ERCOT does not trade significant amounts of power across state lines. Power sales in ERCOT

[28] https://www.naturalgasintel.com/natural-gas-played-starring-role-in-texas-energy-crisis-analysts-find/
[29] https://www.aceee.org/sites/default/files/pdfs/ACEEE_ScrSht20_Texas.pdf
[30] https://www.forbes.com/sites/uhenergy/2019/10/07/demand-response-an-untapped-energy-resource-for-the-grid/?sh=4c4358356f05
[31]https://www.publicpower.org/system/files/documents/rto_capacity_markets_and_their_impacts_on_consumers_and_public_power_0.pdf

are not considered sales in interstate commerce and therefore not under federal jurisdiction.[32] This is a unique feature among RTOs/ISOs; other grid operators operate across multiple states, trade power regionally through the Eastern and Western Interconnections, and are regulated by FERC.[33]

Moreover, the natural gas industry in Texas is regulated not by the PUCT, but by the Texas Railroad Commission. The Railroad Commission has come under criticism for being "industry-friendly" and too "light-touch" to adequately regulate and strengthen the natural gas supply chain.[34] Overall, there is a lack of coordination among state agencies that regulate gas and electricity, including the Railroad Commission, the PUCT, and ERCOT.

3.2 Energy-Only Market Design

Unlike all other RTOs, ERCOT operates as an "energy only" market with no formal capacity market or planning process.

ERCOT operates an energy-only market, meaning that payments to generators are based solely on the energy they provide on a day-to-day basis. Rather than relying on an organized capacity market or other planning process to ensure sufficient peaking capacity, the Texas model aims to ensure reliability mainly through scarcity pricing. That is, when demand is high and power supplies become more scarce, real-time electricity prices are allowed to surge upwards towards a system-wide price cap of $9,000/MWh. For example, during the February 2021 scarcity event, wholesale prices held at or near the $9,000/MWh price cap for approximately 77 hours, from

[32] https://www.utilitydive.com/news/congress-texas-should-rethink-ercots-go-it-alone-approach-ferc-chair/595335/#:~:text=ERCOT%20is%20not%20federally%20regulated,the%20Eastern%20and%20Western%20Interconnections.
[33] https://www.utilitydive.com/news/congress-texas-should-rethink-ercots-go-it-alone-approach-ferc-chair/595335/#:~:text=ERCOT%20is%20not%20federally%20regulated,the%20Eastern%20and%20Western%20Interconnections.
[34] https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/

midnight on February 15 to the morning of February 19, as power plants scrambled to find electricity. For comparison, wholesale prices in ERCOT averaged $22/MWh in 2020.[35]

In contrast, most other RTOs have established price caps at much lower levels typically around $1,000/MWh. The large spikes in real-time power prices in ERCOT are intended to incentivize all generation owners to respond to capacity shortfalls by building new plants and keeping them ready to operate.[36] High wholesale prices also act as a penalty on generators who fail to perform when needed, as contractual obligations often force wholesale buyers to purchase power at the prevailing price.

While there are theoretical economic benefits to scarcity pricing, the February outages have also revealed that this approach has its drawbacks. From a generator's perspective, revenue streams are less secure, so investing in new capacity resources can present more of a financial risk, thus leading to potential underinvestment across the system. By the same token, for grid operators there is both 1) less certainty that sufficient generation capacity will come online in the coming years to meet peak demand and 2) less certainty that the generation online will perform adequately.

Even though ERCOT had modelled various scenarios for difficult winter conditions, in last November's Seasonal Assessment of Resource Adequacy, it had not anticipated such a large deficiency of available generation capacity.[37]

In contrast to the ERCOT model, all of the six remaining RTOs do have either a forward capacity market and/or long-term capacity planning framework to ensure that resource adequacy is met. Four of these RTOs operate an organized forward capacity market. More specifically, ISO-

[35] https://www.eia.gov/todayinenergy/detail.php?id=47876#:~:text=In%20February%202021%2C%20wholesale%20prices,the%20morning%20of%20February%2019.
[36] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf
[37] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/

NE, PJM, MISO, and NYISO operate organized capacity markets which aim to ensure resource adequacy by paying resources to commit capacity for future delivery years. Prices for capacity are established through an auction conducted by the RTO, and load serving entities are obligated to procure enough capacity to meet their fair share of the system's peak load.[38] In some instances capacity resources can be secured through bilateral contracts or can even be self-supplied in the case of vertically integrated utilities that operate in RTOs.

While there has been substantial debate over the years regarding both the design of these markets, and their overall merit, there is also evidence that they have played a role in ensuring greater reliability than the ERCOT model. For example, in recent years PJM has carried a substantial reserve margin, on the order of 30-35%. This may have safeguarded PJM from any capacity shortfalls in the February winter storms.

The remaining two RTOs – CAISO and SPP – do not have organized capacity markets.[39] However, in both cases most market participants are vertically-integrated utilities that are subject to state oversight for resource adequacy and integrated resource planning. While there is no formal capacity market, each utility must demonstrate that it has met its fair share of the RTO's overall resource adequacy requirements. Bilateral markets for capacity also exist in these regions as a means for each utility to secure sufficient capacity resources. It cannot, however, be emphasized enough that the existence of a capacity market would not necessarily be a cure-all for these types of events as the other issues discussed in these comments note equal of not more important considerations in structuring of the grid of the future for South Carolina.

[38] https://www.publicpower.org/system/files/documents/rto_capacity_markets_and_their_impacts_on_consumers_and_public_power_0.pdf
[39] https://www.publicpower.org/system/files/documents/rto_capacity_markets_and_their_impacts_on_consumers_and_public_power_0.pdf

3.2.1 Vertically-integrated Utilities within RTOs

It is important to note that there are multiple approaches to structuring RTOs that can include a variety of different utility business models and reliability considerations. Vertically-integrated utilities can and do operate within RTOs today – even those with capacity markets. For example, it is common for vertically-integrated utilities to operate within MISO territory with state public utilities commissions continuing to provide oversight over certain aspects of utility operations. Resource adequacy is overseen by a combination of regulatory bodies, including LSEs, states, RTOs/ISOs, FERC, and NERC. For example, Dominion Energy South Carolina, in its modified 2020 IRP, plans to meet a minimum 21% winter reserve margin and a minimum 14% summer reserve margin,[40] while Dominion Energy plans for reserve margins in the approximately 19% to 24% range in Virginia, which operates within PJM's footprint.[41]

3.3 No Required Reserve Margin

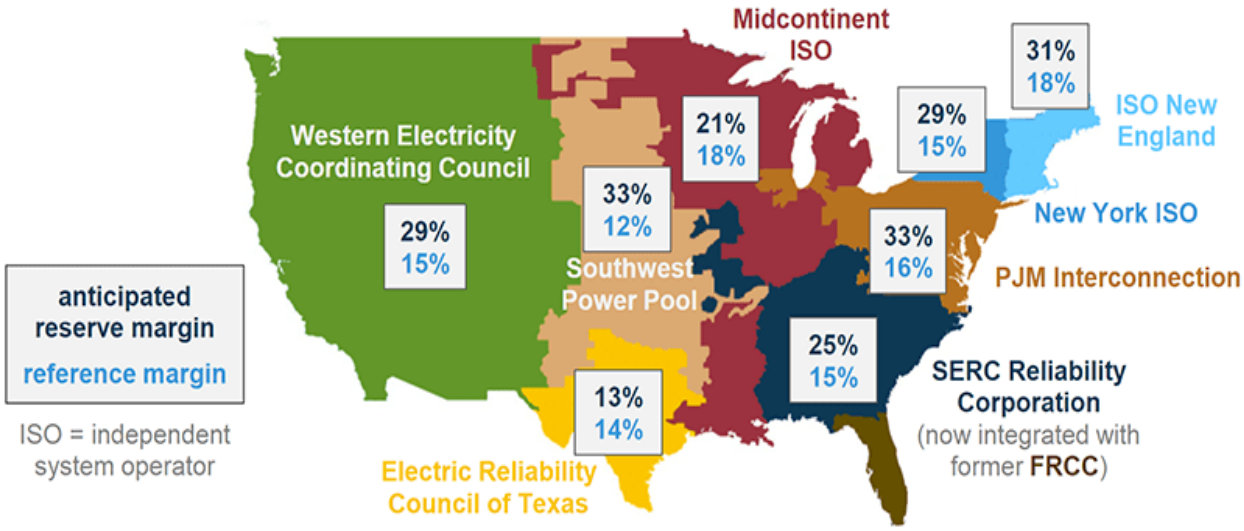
In recent years, ERCOT has held one of the lowest reserve margins in the country.

In contrast to other RTOs, ERCOT does not have a mandatory planning reserve margin. Although there are guidelines, these had also been slowly decreasing over time in the run up to the February outages. According to NERC, the 2020 anticipated reserve margin for ERCOT was approximately 13% of peak demand,[42] while reserve margins through the rest of the country ranged from 21% in MISO to 33% in PJM and SPP, as illustrated in the figure below. ERCOT's reserve margins began to trend downward in 2010, although capacity additions in 2019 somewhat

[40] https://cdn-dominionenergy-prd-001.azureedge.net/-/media/pdfs/global/company/desc-2020-integrated-resource-plan.pdf?la=en&rev=bcaa0f89a3614b018995f4b43c0273e9
[41] https://www.dominionenergy.com/-/media/pdfs/global/2020-va-integrated-resource-plan.pdf?la=en&rev=fca793dd8eae4ebea4ee42f5642c9509
[42] http://www.ercot.com/gridinfo/resource

bolstered reserves. To a large extent, ERCOT's low reserve margin is an expected outcome of managing resource adequacy through an energy-only market construct.[43]

Figure 3. Summer 2020 Reference Margins and Anticipated Reserve Margins in Select NERC Regions[44]



Source: US EIA, based on NERC 2020 Summer Reliability Assessment

3.3.1 PJM's Reserve Margin During a Polar Vortex

In 2014, PJM experienced a polar vortex that resulted in a 22% forced outage rate among its generators. In response, PJM implemented a new set of market rules called Capacity Performance that focused on improving performance during system emergencies by strengthening penalties for non-performance. PJM and its members put in place additional measures, such as deployment of more efficient generation resources, increased investment in existing resources, improved performance incentives, enhanced winterization measures, and

[43] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf
[44] "A reserve margin takes into account the amount of resources anticipated to be available to meet net internal electricity demand.…Reference margins are reserve margin targets based on each area's load, generating capacity, and transmission characteristics. The EIA noted that reliability entities in each region aim to have their anticipated reserve margins surpass their planning reference margins, and that some states, provinces, independent system operators, or other regulatory bodies require an anticipated reserve margin at least as big as the planning reference margin." https://www.naturalgasintel.com/summer-reliability-assessment-ercot-electricity-reserve-margin-lags-behind-rest-of-the-united-states/

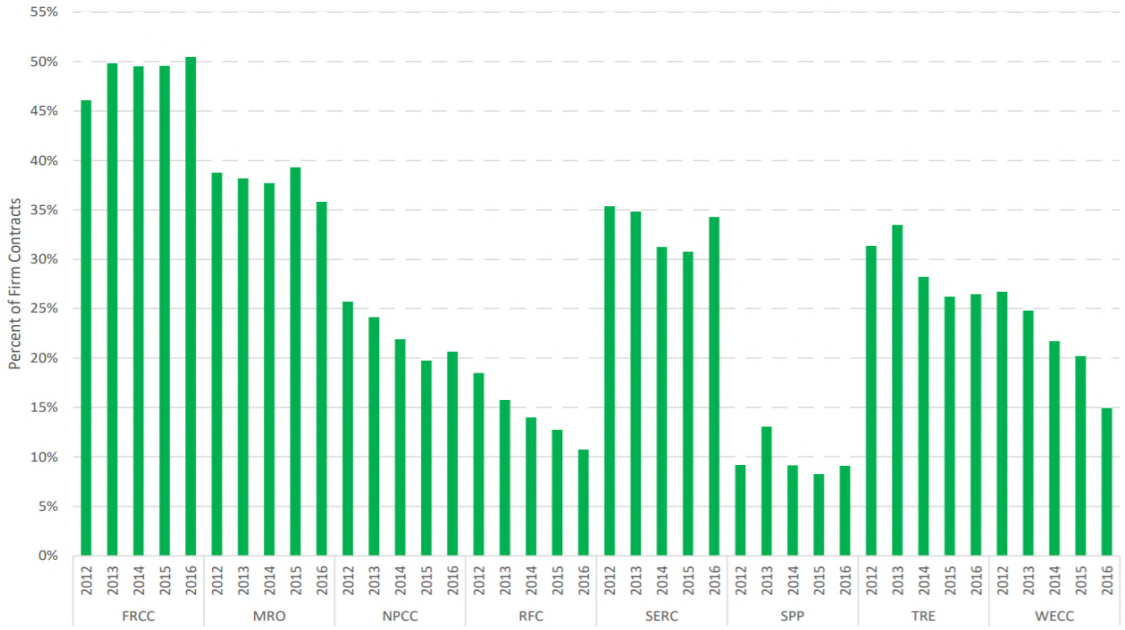
increased gas-electric coordination.[45] A later cold snap in the winter of 2017-2018, although milder than the 2014 polar vortex, suggested that these changes were successful, as forced outage rates dropped to 11-12%.[46]

3.4 Lack of Required Firm Contracts for Fuel

A large reason for the supply shortage is that power plants had not contracted for firm supply for natural gas.[47]

In Texas, less than a third of natural gas contracts are for firm supply, which guarantee enough supply to meet demand and lock in prices. Instead, most contracts are procured via the spot market.[48] The figure below shows the percentage of firm fuel contracts by NERC region; TRE (Texas Reliability Entity) corresponds to the ERCOT region.

Figure 4. Percent of firm fuel contracts 2012-2016 by NERC Region



[45] https://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180220-qfrs-submitted-to-andrew-ott-from-20180123-senate-committee-hearing.ashx
[46] https://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180220-qfrs-submitted-to-andrew-ott-from-20180123-senate-committee-hearing.ashx
[47] https://www.greentechmedia.com/squared/dispatches-from-the-grid-edge/looking-for-fixes-to-what-broke-the-texas-power-grid
[48] https://www.netl.doe.gov/projects/files/EnsuringReliableNaturalGasFiredPowerGenerationWithFuelContractsAndStorage_111717.pdf

Source: National Energy Technology Laboratory (2017), "Ensuring Reliable Natural Gas-Fired Power Generation with Fuel Contracts and Storage," https://www.netl.doe.gov/projects/files/EnsuringReliableNaturalGasFiredPowerGenerationWithFuelContractsAndStorage_111717.pdf.
Note that FRCC=Florida Reliability Coordinating Council (now integrated within SERC); MRO=Midwest Reliability Organization (includes MISO); NPCC=Northeast Power Coordinating Council (includes ISO-NE and NYISO); RFC=Reliability First Corporation (includes PJM); SERC= SERC Reliability Corporation; SPP=Southwest Power Pool; TRE=Texas Reliability Entity (includes ERCOT); and WECC=Western Electricity Coordinating Council (includes CAISO).

Although ERCOT is more dependent on natural gas than the Eastern Interconnection and Western Interconnection,[49] it does not have the same access to underground natural gas storage facilities. The state's pipeline network is configured to export gas into colder regions, such as the northeast, during the winter months. On February 15, the first day of the energy crisis, 38% of the natural gas came from storage.[50]

As natural gas supplies dropped, prices spiked, and power plants found themselves looking for scarce molecules of gas that producers were also bidding on. Producers trying to maintain their contractual volumes were buying gas for $200/MMBtu to make up for volumes they had sold for $2.50.[51] Daily cash prices in the Midcontinent went as high as $1,250/MMBtu for some deals, while at the beginning of February, prices were below $3/MMBtu.[52]

The chart above shows that several regions, including ERCOT, had experienced declines in firm contracts for fuel through 2016. However, some RTOs have taken more proactive steps since then to ensure generator performance, including through firm fuel supplies. For example, the new Capacity Performance rules established by PJM in the 2015 timeframe have led to more than

[49] Id.
[50] https://www.naturalgasintel.com/no-easy-answers-as-texas-power-grid-natural-gas-market-rocked-by-unprecedented-cold-snap/
[51] https://www.texasmonthly.com/news-politics/texas-blackouts-natural-gas/
[52] https://www.woodmac.com/news/opinion/the-texas-energy-crisis-its-causes-and-consequences/

a doubling of firm supply of natural gas.[53] Furthermore, ISO-NE and NYISO have established processes to encourage generators to maintain dual fuel supplies to ensure redundancy on the system.

To our knowledge, neither of these approaches were taken by ERCOT prior to the February outages, which likely resulted in fewer firm fuel contracts and in turn worsened the crisis.

4. Key Conclusions

In reviewing the relevant factors that contributed to the February electricity crisis in Texas, there are a number of key takeaways that are worth considering.

First, there were a variety of physical performance issues that contributed to the crisis. Most of these are potential risk factors in any market structure – both in RTOs just as the risk would exist in territories like South Carolina which currently lack any form of an organized competitive energy market. However, the fact that the ERCOT grid is islanded from other interconnections in the US is a unique factor that is unlikely to affect operations in the Eastern Interconnection. Furthermore, while additional power plant winterization may be needed in many places, the failure of Texas to heed previous warnings in the aftermath of the 2011 cold snap is especially noteworthy.

Second, there were several market design issues within ERCOT that likely exacerbated the February outages. Chief among these was ERCOT's energy-only market design, which deemphasized long-term reliability planning and contributed to a relatively low reserve margin. Crucially, this is not a symptom of the RTO construct writ large, but rather was a conscious design

[53] https://www.pjm.com/-/media/library/reports-notices/capacity-performance/20180620-capacity-performance-analysis.ashx#:~:text=In%20response%20to%20changing%20grid,especially%20in%20extreme%20weather%20conditions.

choice of Texas decision-makers, that can be avoided elsewhere. Notably, all other RTOs have some form of capacity market or other reliability planning process.

Finally, we note that none of the factors reviewed – whether related to physical performance or market design – are inherent to the RTO model. In fact, if South Carolina ultimately decides to pursue an RTO, as is currently being explored by the General Assembly of South Carolina with input from customers and utilities under Act 187 of 2020[54] the ERCOT experience provides many useful lessons on how to avoid certain missteps that could threaten grid reliability.

The table on the next page provides a summary of the issues reviewed and an assessment of which ones are inherently linked to the RTO-model and which ones are unique to ERCOT. We hope that the PSC will consider this in its assessment of reliability going forward. As mentioned, we believe that the ERCOT experience should not be characterized as an outcome of the RTO model. On the contrary, if an RTO construct is implemented in South Carolina that incorporates the lessons learned from the ERCOT outages, we believe this will lead to a more reliable grid than the status quo.

[54] https://www.scstatehouse.gov/sess123_2019-2020/bills/4940.htm

Contributing Factors to February 2021 ERCOT Outages	Inherent to the RTO model?	Unique to ERCOT?
Physical Performance Issues		
Islanded electrical grid	No	Yes
Lack of power plant weatherization	No	No
Failures at gas production wells	No	No
Inefficiency of end use consumption	No	No
Market Design Issues		
Lack of regulatory oversight	No	Yes
Energy-only market design	No	Yes
No required reserve margin	No	Yes
Lack of firm fuel contracts	No	No

In addition to the foregoing, we further refer to the attached Exhibit A, titled "Appendix: Summary of Recommendations from FERC/NERC 2011," for the Commission's consideration.

<signature page follows>

Accordingly, Google, LLC, respectfully submits its Comments in the above-captioned proceeding.

NELSON MULLINS RILEY & SCARBOROUGH LLP

By: s/ Weston Adams, III
Weston Adams, III (SC Bar No. 64291)
E-Mail: weston.adams@nelsonmullins.com
Courtney E. Walsh (SC Bar No. 72723)
E-Mail: court.walsh@nelsonmullins.com
1320 Main Street / 17th Floor
Post Office Box 11070 (29211-1070)
Columbia, SC 29201
(803) 799-2000

Attorneys for Google, LLC

Columbia, South Carolina
June 11, 2021

Exhibit A

Appendix: Summary of Recommendations from FERC/NERC 2011

A.1. Electricity

A.1.1. Planning and reserves

1. Balancing Authorities, Reliability Coordinators, Transmission Operators and Generation Owner/Operators in ERCOT and in the southwest regions of WECC should consider preparation for the winter season as critical as preparation for the summer peak season.
2. Planning authorities should augment their winter assessments with sensitivity studies incorporating the 2011 event to ensure there are sufficient generation and reserves in the operational time horizon.
3. Balancing Authorities and Reserve Sharing Groups should review the distribution of reserves to ensure that they are useable and deliverable during contingencies.
4. ERCOT should reconsider its protocol that requires it to approve outages if requested more than eight days before the outage, consider giving itself the authority to cancel outages previously scheduled, and expand its outage evaluation criteria.
5. ERCOT should consider modifying its procedures to (i) allow it to significantly raise the 2300 MW responsive reserve requirement in extreme low temperatures, (ii) allow it to direct generating units to utilize preoperational warming prior to anticipated severe cold weather, and (iii) allow it to verify with each generating unit its preparedness for severe cold weather, including operating limits, potential fuel needs and fuel switching abilities.

A.1.2. Coordination with generator owners/operators

6. Transmission Operators, Balancing Authorities, and Generation Owner/Operators should consider developing mechanisms to verify that units that have fuel switching capabilities can periodically demonstrate those capabilities.
7. Balancing Authorities, Transmission Operators and Generator Owners/Operators should take the steps necessary to ensure that black start units can be utilized during adverse weather and emergency conditions.
8. Balancing Authorities, Reliability Coordinators and Transmission Operators should require Generator Owner/Operators to provide accurate ambient temperature design specifications.
9. Balancing Authorities, Reliability Coordinators and Transmission Operators should verify that temperature design limit information is kept current and should use this information to determine whether individual generating units will be available during extreme weather events.
10. Transmission Operators and Balancing Authorities should obtain from Generator Owner/Operators their forecasts of real output capability in advance of an anticipated severe weather event; the forecasts should take into account both the temperature beyond which the availability of the generating unit cannot be assumed, and the potential for natural gas curtailments.
11. Balancing Authorities should plan ahead so that emergency enforcement discretion regarding emission limitations can be quickly implemented in the event of severe capacity shortages.

A.1.3. Winterization

12. States in the Southwest should examine whether Generator/Operators ought to be required to submit winterization plans, and should consider enacting legislation where necessary and appropriate.
13. Consideration should be given to designing all new generating plants and designing modifications to existing plants (unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available, factoring in accelerated heat loss due to wind speed.
14. The temperature design parameters of existing generating units should be assessed.
15. Generator Owner/Operators should ensure that adequate maintenance and inspection of its freeze protection elements be conducted on a timely and repetitive basis.
16. Each Generator Owner/Operator should inspect and maintain its generating units' heat tracing equipment.
17. Each Generator Owner/Operator should inspect and maintain its units' thermal insulation.
18. Each Generator Owner/Operator should plan on the erection of adequate wind breaks and enclosures, where needed.
19. Each Generator Owner/Operator should develop and annually conduct winter-specific and plant-specific operator awareness and maintenance training.
20. Each Generator Owner/Operator should take steps to ensure that winterization supplies and equipment are in place before the winter season, that adequate staffing is in place for cold weather events, and that preventative action in anticipation of such events is taken in a timely manner.
21. Transmission Operators should ensure that transmission facilities are capable of performing during cold weather conditions.

A.1.4. Communications

22. Balancing Authorities should improve communications during extreme cold weather events with Transmission Owner/Operators, Distribution Providers, and other market participants.
23. ERCOT should review and modify its Protocols as needed to give Transmission Service Providers and Distribution Service Providers in Texas access to information about loads on their systems that could be curtailed by ERCOT as Load Resources or as Emergency Interruptible Load Service.
24. WECC should review its Reliability Coordinator procedures for providing notice to Transmission Operators and Balancing Authorities when another Transmission Operator or Balancing Authority within WECC is experiencing a system emergency (or likely will experience a system emergency), and consider whether modification of those procedures is needed to expedite the notice process.
25. All Transmission Operators and Balancing Authorities should examine their emergency communications protocols or procedures to ensure that not too much responsibility is placed on a single system operator or on other key personnel during an emergency, and should consider developing single points of contact (persons who are not otherwise responsible for emergency operations) for communications during an emergency or likely emergency.

A.1.5. Load shedding

26. Transmission Operators and Distribution Providers should conduct critical load review for gas production and transmission facilities, and determine the level of protection such facilities should be accorded in the event of system stress or load shedding.
27. Transmission Operators should train operators in proper load shedding procedures and conduct periodic drills to maintain their load shedding skills.

A.2. Natural Gas

1. Lawmakers in Texas and New Mexico, working with their state regulators and all sectors of the natural gas industry, should determine whether production shortages during extreme cold weather events can be effectively and economically mitigated through the adoption of minimum, uniform standards for the winterization of natural gas production and processing facilities.
2. The gas and electric sectors should work with state regulatory authorities to determine whether critical natural gas facilities can be exempted from rolling blackouts.
3. State utility commissions should work with LDCs to ensure that voluntary curtailment plans can reduce demand on the system as quickly and efficiently as possible when gas supplies are disrupted.
4. State utility commissions should work with balancing authorities, electrical generators, and LDCs to determine whether and under what circumstances residential gas customers should receive priority over electrical generating plants during a gas supply emergency.
5. State utility commissions and LDCs should review the events of early February 2011 and determine whether distribution systems can be improved to increase flows during periods of high demand.
6. State utility commissions should work with LDCs to determine whether the LDC distribution systems can be improved so that curtailments can be implemented, when necessary, in a way that improves the speed and efficiency of the restoration process.

Source: Staffs of the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation (August 2011), Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011: Causes and Recommendations, https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf, pgs. 195-217.

STATE OF SOUTH CAROLINA

BEFORE THE PUBLIC SERVICE COMMISSION

Docket No. 2021-66-A

In the Matter of: South Carolina Office of Regulatory Staff's Motion to Solicit Comments from Utilities and Other Interested Stakeholders Regarding Measures to Be Taken to Mitigate Impact of Threats to Safe and Reliable Utility Service	)	**CERTIFICATE OF SERVICE**

This is to certify that I have caused to be served this day one copy of the **Google, LLC's Filed Comments** to the persons named below at the addresses set forth via electronic mail and e-filing:

Benjamin P. Mustian, Esquire
Office of Regulatory Staff
bmustian@ors.sc.gov

Roger P. Hall, Asst. Consumer Advocate
SC Department of Consumer Affairs
rhall@scconsumer.gov

Heather S. Smith, Esquire
Duke Energy Carolinas, LLC
Duke Energy Progress, LLC
heather.smith@duke-energy.com

K. Chad Burgess, Esquire
Dominion Energy SC, Inc.
chad.burgess@dominionenergy.com

Amber D. Daniels, Esq.
Stephen R. Pelcher, Esq.
South Carolina Public Service Authority
amber.daniels @santeecooper.com
srpelche@santeecooper.com

Christopher S. McDonald
The Tiencken Law Firm, LLC
cmcdonald@tienckenlaw.com

Derrick Price Williamson
Spilman Thomas & Battle PLLC
dwilliamson@spilmanlaw.com

Frank Partridge, Jr.
frankpartridge@1stcounsel.com

John H. Tiencken, Jr.
Tiencken Law Firm, LLC
jtiencken@tienckenlaw.com

Karen L Hallenbeck
The Tiencken Law Firm, LLC
khallenbeck@tienckenlaw.com

M. John Bowen, Jr.
Burr & Forman LLP
jbowen@Burr.com

T. Richmond McPherson III
McGuire Woods LLP
rmcpherson@mcguirewoods.com

Jenny R. Pittman, Esquire
Office of Regulatory Staff
jpittman@ors.sc.gov

Carri Grube-Lybarker, Esquire
SC Department of Consumer Affairs
clybarker@scconsumer.gov

Rebecca J. Dulin, Esquire
Duke Energy Carolinas, LLc
Duke Energy Progress, LLC
Rebecca.dulin@duke-eneryg.com

Matthew W. Gissendanner, Esquire
Dominion Energy SC, Inc.
Matthew.gissendanner@dominionenergy.com

Margaret M. Fox
Burr & Forman LLP
pfox@burr.com

Rion D. Foley
Burr& Forman LLP
RFoley@burr.com

Scott Elliott
Elliott & Elliott, P.A.
selliott@elliottlaw.us

Stephanie U. (Roberts) Eaton
Spilman Thomas & Battle, PLLC
seaton@spilmanlaw.com

/s/ Weston Adams, III
Weston Adams, III

Columbia, South Carolina
June 11, 2021